

Can we use on-farm tests for diagnosing intramammary infection at dry off in dairy cows?

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Introduction

Implementing selective dry cow therapy as an alternative to systematic antimicrobial use at dry off on dairy farms can play a role in decreasing antimicrobial use. While on-farm bacteriological tests have been validated to identifying intramammary infection (IMI), a cow-side test such as ATP luminometry could be a quick, simple, and cheap alternative. In this study, we aimed to assess the validity of various diagnostic tests in identifying intramammary infection (IMI) in dairy cows at dry off. We compared the validity of laboratory bacteriological culture, *vs.* on-farm Petrifilm® and Tri-Plate culture systems, *vs.* luminometry.

Materials and methods

To conduct the study, composite milk samples were collected from cows before dry off between September 2020 and December 2021. Each sample was tested with luminometry, Petrifilm (aerobic count plate), Tri-Plate, and laboratory culture. We categorized IMI using thresholds of ≥ 100 CFU/mL for laboratory culture, ≥ 50 CFU/mL for Petrifilm, and ≥ 1 CFU for Tri-Plate. For luminometry, we assessed multiple thresholds of relative light units (RLU; 50 to 300). We fitted Bayesian latent class models designed for comparing imperfect tests between them. We estimated the sensitivity and specificity of each test, along with predictive values and misclassification cost terms (MCT) at varying false-negative to false-positive ratios, under different prevalence measures (0.30, 0.50 and 0.70). Results are presented as median estimate with 95% Bayesian credibility intervals (BCI).

Results

A total of 294 cows from a commercial Holstein herd were included in the study. Results indicated that luminometry showed poor validity across all thresholds tested, with a sensitivity of 0.51 (95% BCI = 0.43-0.59) and a specificity of 0.38 (95% BCI = 0.26-0.50) when using a threshold of ≥ 150 RLU. Conversely, laboratory culture, Petrifilm, and Tri-Plate demonstrated higher sensitivity and specificity values. Indeed, laboratory culture had a sensitivity of 0.93 (95% BCI = 0.85-0.98) and a specificity of 0.69 (95% BCI = 0.49-0.89), Petrifilm had a sensitivity of 0.91 (95% BCI = 0.80-0.98) and a specificity of 0.71 (95% BCI = 0.51-0.90), while Tri-Plate had a sensitivity of 0.65 (95% BCI = 0.53-0.82) and a specificity of 0.85 (95% BCI = 0.66-0.97). The bacteriological tests generally had good predictive values, although the Tri-Plate had lower negative predictive value compared to the laboratory culture and the Petrifilm. For a prevalence of IMI of 0.30, all bacteriological tests showed similar MCT. However, at prevalences of 0.50 and 0.70, the Tri-Plate demonstrated higher MCT in scenarios where the consequences of leaving a cow with IMI untreated outweighed treating a healthy cow.

Significance

In conclusion, while luminometry proved ineffective for identifying IMI at dry off, both Petrifilm and Tri-Plate tests showed performances comparable to laboratory culture, contingent upon IMI prevalence and the relative importance of false-positive *vs.* false-negative results.

